$$\int u\,dv = uv - \int v\,du$$

Name the parts u and dv

$$\int x\,e^x\,dx$$

$u = x \qquad dv = e^x dx$

Then find du & v:

$du = dx \qquad v = \int e^x dx$

$v = e^x$

$$\int x\,e^x\,dx = xe^x - \int e^x dx$$

$$= xe^x - e^x + C$$

HW Questions: p. 506

1. $\int xe^{2x}\,dx$
3. $\int xe^{x^2}\,dx$
5. $\int xe^{-2x}\,dx$
7. $\int x^3e^x\,dx$
9. $\int x^3 \ln x\,dx$

13. $\int (\ln x)^2\,dx$

$u = (\ln x)^2 \qquad dv = 1\,dx$

$du = 2(\ln x)\frac{1}{x}\,dx \qquad v = x$

$= x(\ln x)^2 - \int x\left(2(\ln x)\frac{1}{x}\,dx\right)$

$= x(\ln x)^2 - 2\int (\ln x)\,dx \qquad u = \ln x \qquad dv = 1\,dx$

$du = \frac{1}{x}\,dx \qquad v = x$

$= x(\ln x)^2 - 2\left[x\ln x - \int x\cdot\frac{1}{x}\,dx\right]$

19. $\int (x^2 - 1)e^x\,dx$

$u = x^2 - 1 \qquad dv = e^x\,dx$

$du = 2x\,dx \qquad v = e^x$

	$u\downarrow$	$dv\uparrow$
+	x^2-1	e^x
−	$2x$	e^x
+	2	e^x
−	0	e^x

21. $\int x\sqrt{x-1}\,dx$

$u = x \qquad dv = (x-1)^{1/2}\,dx$

$du = 1\,dx \qquad \int (x-1)^{1/2}\,dx$

$v = \frac{2(x-1)^{3/2}}{3}$

25. $\int x\cos x\,dx$

21) $= \frac{2}{3}x(x-1)^{3/2} - \frac{2}{3}\int (x-1)^{3/2}\,dx$

$\frac{2}{3}x(x-1)^{3/2} - \frac{4}{15}(x-1)^{5/2} + C$

Summary of Common Integrals

and best approach for Integration by Parts

1) $\int x^n \sin x\,dx$, $\int x^n \cos x\,dx$, $\int x^n e^x\,dx$ } let $u = x^n$

2) $\int x^n \ln x\,dx$, $\int x^n \arcsin x\,dx$, $\int x^n \arccos x\,dx$ } * No $\int \ln x$, arcsin, arccos Basic Formulas. Let u = those, $dv = x^n\,dx$

3) $\int e^x \sin x\,dx$, $\int e^x \cos x\,dx$ } OK either way. Slightly easier if Let $u = \sin x$ / $\cos x$ $dv = e^x\,dx$

Looking for a Constant Multiple

(Like Terms to Combine)

$\int e^x \cos 2x\,dx$ Let $u = \cos 2x$, $du = -2\sin 2x\,dx$; $dv = e^x\,dx$, $v = e^x$

$\int e^x \cos 2x\,dx = e^x \cos 2x - \int e^x(-2\sin 2x)\,dx$

$\int e^x \cos 2x\,dx = e^x \cos 2x + 2\int e^x \sin 2x\,dx$ $u = \sin 2x$, $du = 2\cos 2x$, $dv = e^x dx$, $v = e^x$

$\int e^x \cos 2x\,dx = e^x \cos 2x + 2e^x \sin 2x - 2\int v\,du$

$\int e^x \cos 2x\,dx = e^x \cos 2x + 2e^x \sin 2x - 4\int e^x \cos 2x\,dx$

$+4\int e^x \cos 2x\,dx$ $+4\int e^x \cos 2x\,dx$

$5\int e^x \cos 2x\,dx = e^x \cos 2x + 2e^x \sin 2x + C$

$\int e^x \cos 2x\,dx = \frac{e^x}{5}\cos 2x + \frac{2e^x}{5}\sin 2x + C$

BASIC INTEGRATION FORMULAS p. 473

1. $\int kf(u)\,du = k\int f(u)\,du$
2. $\int [f(u) \pm g(u)]\,du = \int f(u)\,du \pm \int g(u)\,du$
3. $\int du = u + C$
4. $\int u^n\,du = \frac{u^{n+1}}{n+1} + C,\ n \neq -1$
5. $\int \frac{du}{u} = \ln|u| + C$
6. $\int e^u\,du = e^u + C$
7. $\int \sin u\,du = -\cos u + C$
8. $\int \cos u\,du = \sin u + C$
9. $\int \tan u\,du = -\ln|\cos u| + C$
10. $\int \cot u\,du = \ln|\sin u| + C$
11. $\int \sec u\,du = \ln|\sec u + \tan u| + C$
12. $\int \csc u\,du = -\ln|\csc u + \cot u| + C$
13. $\int \sec^2 u\,du = \tan u + C$
14. $\int \csc^2 u\,du = -\cot u + C$
15. $\int \sec u \tan u\,du = \sec u + C$
16. $\int \csc u \cot u\,du = -\csc u + C$
17. $\int \frac{du}{\sqrt{a^2 - u^2}} = \arcsin\frac{u}{a} + C$
18. $\int \frac{du}{a^2 + u^2} = \frac{1}{a}\arctan\frac{u}{a} + C$
19. $\int \frac{du}{u\sqrt{u^2 - a^2}} = \frac{1}{a}\operatorname{arcsec}\frac{|u|}{a} + C$

HW: p. 506, # 27, 31, 39, 41, 43, 63

Finish up all the FR practice by Monday

HW Quiz next Tuesday

pgs. 456, 497, 506 from last Friday only